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# PATENT SPECIFICATION

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and WILLIAM

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## COMPLETE SPECIFICATION

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## Method and apparatus for lining pipe

We, PIPE LININGS, INC., a Corporation organised and existing under the laws of the State of California, United States of America, of 2414 East 223rd Street, Wil-

5 mington, California, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly de-

10 scribed in and by the following statement:—

This invention has to do generally with the lining of pipelines of relatively small diameter in the approximate range of from four to twelve inches with a relatively thin lining 15 of a coating material which is highly resistant or substantially impervious to chemical and bacterial action, and with somewhat less impervious material, such as cement mortar.

One problem in the lining of pipe in 20 place in the ground or at a distance from the source of supply of the lining material, where such material is of a nature which hardens or sets quickly once it is mixed, has been the tendency for the material to 25 harden or set before it is applied as a lining, and also where shutdowns or removal of the apparatus have been necessary, the material may harden in the supply hoses leading to the machine, with the consequent 30 difficulty of cleaning out the material.

An object of the invention is to provide 35 a novel method and apparatus for overcoming the above-noted difficulties wherein the material is applied substantially immediately after the final combining and mixing of the materials, and of providing such apparatus where there is no loss of material or possibility of its hardening in the hose lines leading from the source of supply to the 40 machine.

Another object is to provide a novel lining machine which embodies means for combining and mixing two materials and apply-

ing them to the pipe wall substantially immediately thereafter.

A further object is to provide a novel lining machine for the application of material which requires heating.

These and other objects will be apparent from the drawings and the following description. Referring to the drawings:

Fig. 1 is a sectional elevational view of apparatus embodying one form of the invention shown in place in a pipe to be lined;

Fig. 2 is a sectional view on line 2-2 of Fig. 1;

Fig. 3 is an enlarged sectional view on line 3-3 of Fig. 1;

Fig. 4 is a fragmentary central longitudinal sectional view of a modified form of the machine of Fig. 1; and

Fig. 5 is a fragmentary elevational view of the applicator head of Fig. 4;

More particularly describing the invention, referring first to Figs. 1 to 3, we show a lining machine 10 disposed in a pipeline 11 and adapted to be advanced by a cable, not shown, which is attached to an eye bracket 12 on a fitting 13 at the forward end of the 70 machine, such cable being normally attached and wound upon a winch (not shown) at the ground level at some distance from the machine.

The machine includes a motor 14 and 75 gear reduction unit 15. The motor may be either electric or pneumatic and a fitting 16, which is hollow, may be used for attaching the appropriate cable or air line as the case may be. A plurality of spring fingers 17 serve to center the machine in the pipe.

The lining machine includes a tubular housing or casing member 18 which is internally threaded and mounted on the threaded end 19 of the unit 15. A power 85 shaft 20 driven by the motor extends into

[Price 4s. 6d.]

the interior of a chamber 21 defined by the casing member 18 and serves to drive a mixer shaft 23 which is journaled in a bearing 24 mounted in the housing against a shoulder 25. Seals 26 and 27 are provided on opposite sides of the bearing. The mixer shaft extends forwardly of the casting member into a mixing chamber 28 formed in part by housing 18 and by an extension 30 which threads onto the end of the housing member. The mixer shaft is provided with a plurality of vanes or blades 31 which are helically disposed. These are shown as part of a continuous helix interrupted by axial slots 32, but this construction is not essential.

Leading to the mixing chamber 28 are two inlet passages 33 and 34, each of which is fitted with a forwardly extending tube, these being designated 35 and 36, respectively. The forward ends of the tubes (not shown) terminate a short distance ahead of the fitting 17 and are intended and adapted for the attachment of material supply hoses (not shown) which would lead to the surface of the ground or other appropriate place where the supply of material is located.

Rearwardly of the mixing chamber we provide means for distributing and smoothing or troweling a layer of the lining material 38, which issues from the mixing chamber through holes 39, on the inner surface of the pipe. This means includes a flared tube 40 mounted on member 30 and a material-retaining member 41 of flexible and resilient material, such as rubber reinforced with fabric or suitable fibers which is adapted to fit snugly against the inner surface of the pipe, the periphery 42 being bevelled for that purpose.

Spaced rearwardly of member 41 we provide a trailing spreader which includes a nose section 44 that is connected to the rear wall 45 of member 30 by means of a ball-and-socket joint 46. Trailing rearwardly of the nose section are a plurality of overlapping leaves 48 of sheet metal which together define a frusto-conical section 49 adapted to spread and thin the lining material to the desired coating thickness. The individual leaves are attached to the nose member 44 at their forward ends by means of bolts 50 which are provided with springs 51 inside the nose and nuts 52 so that there is considerable flexibility at the connection.

The leaves are urged outwardly by a coil spring 53 in the shape of a ring which is positioned between retaining brackets 54 and 55 on the individual leaves. The expansion of the assembly is limited by rings 56 connected to eyes 57 of adjacent leaves.

In the operation of the machine thus far described, the lining machine is placed in the pipe to be lined and connected by a cable to a winch or other means for draw-

ing the machine through the pipe. The inlet pipes 35 and 36 are connected to supply hoses leading to the source of the material to be lined and suitable pump means is provided for forcing the material through the hoses 70 to the machine.

Where the material is of a type which sets or hardens very quickly once all the ingredients have been combined, the material is kept divided at the surface so that some 75 of the ingredients enter the machine through tube 35 and the remainder through tube 36 from which they pass into the mixing chamber 28 where they are combined and mixed and substantially immediately discharged 80 through the openings 39. As the machine advances in the direction of the arrow 60 the material 38 issues through the annular space 61, 62, being discharged ultimately by the spreader at the trailing edge 63 thereof in a 85 thin coating 38'. The rate of travel of the machine is adjusted to the volume output of the material pump in order to place the desired thickness of lining on the pipe wall.

Referring now to Figs. 4 and 5, we show 90 a special head 70 for use where the material is applied by centrifugal force, or in other words flung against the inner wall of the pipe, and where the material must be heated. In Fig. 4 the lining machine is essentially 95 the same as that used in Fig. 1, except that the head 70 replaces the material spreading and troweling means. The head 70 comprises a body 71 having an internal bore 72 to receive the end of an extension 30A on 100 the body 18 of the machine. The head is also provided with a counterbore 74 at its forward end and with an enlarged annular chamber 75 at its trailing end. The latter receives the material to be lined from the 105 mixing chamber and the material then escapes through a plurality of passages 76 leading to the periphery of the head. The latter is carried upon a special or long mixer shaft 23A and thus rotates with it so that the material is discharged by the action of 110 centrifugal force.

Member 30A is fitted with a ring 78 of electrical insulation material which carries 115 two collector rings 80, and these may be provided with suitable electric conductors adapted to lead to a source of electric current. The head contains brushes 81 which contact the respective rings in order to furnish current to one or more electric heater 120 elements 82 in the body of the device.

Although we have illustrated and described a preferred form of our invention, we contemplate that various changes and modifications can be made therein without departing from the invention, the scope of which is indicated by the following claims.

#### WHAT WE CLAIM IS:—

1. The method of lining a pipeline or the like with a coating of a material having the

- property of quick-setting or quick-hardening when the ingredients thereof are combined, which comprises providing a supply of the ingredients in at least two separate supply containers with the ingredients so separated that the ingredients in either container will not set or harden in the absence of the ingredients of the other container, conveying the ingredients from said supply containers in separate conduits to the site within the pipeline where the material is to be applied, combining and mixing the ingredients from said supply containers at said site, and immediately thereafter applying the resulting coating material to the interior surface of the pipeline.
2. The method as claimed in Claim 1 in which the material is pumped through the conduits from the supply containers in proportion to the proper relation of the ingredients thereof in the final coating material.
3. A machine for lining pipelines, comprising a motor, housing means defining a mixing chamber, a mixer shaft journaled in said housing and driven by said motor, said shaft having mixing blades, said housing having a pair of inlets to said chamber adjacent the forward end thereof and having an outlet at the other end thereof, and a material-spreading, and troweling assembly attached in trailing relation to said housing.
4. The machine as claimed in Claim 3 in which the material-spreading and troweling assembly comprises means forming a rearwardly diverging annular passage from the mixing chamber to the pipe to be lined and a frusto-conical spreader in trailing relation thereto formed of a plurality of circumferentially overlapping leaves and spring means urging the same radially outward.
5. The machine as claimed in Claim 3, wherein said material-spreading and troweling assembly comprises: a rotary slinger head encompassing said other end of said housing means and fixed to said mixer shaft, electric heating element means in said head, and electric conductor means adapted to be connected to a source of electric energy operatively connected to said heating element means.
6. The method as described in the accompanying description with reference to the accompanying drawings.
7. The machine as described in the accompanying description with reference to the accompanying drawings.

POTTS, KERR & O'BRIEN.

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**1,150,810**  
**2 SHEETS**

## **COMPLETE SPECIFICATION**

This drawing is a reproduction of  
the Original on a reduced scale.  
**SHEET 2**

